THE *VALESINA* MORPH OF THE BUTTERFLY *ARGYNNIS PAPHIA* (L.) IN CORSICA, 1988

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Introduction

IN SOME populations of the Silver-washed Fritillary butterfly, *Argynnis paphia* (L.), the females are dimorphic. In Britain and continental Europe most females are of the fulvous colour characteristic of many large fritillary species, although duller than the males. There may, however, be a second female morph, *valesina* Esper, which has a dull greenish-grey ground colour on the upper surface of the wings, but with the same pattern of dark spots as the normal female. In southern England some populations have the *valesina* form at a high enough frequency to be regarded as polymorphic, in others it is a rare variation, and in others again it is absent.

The genetics of the *valesina* polymorphism was investigated in breeding experiments by Goldschmidt and Fischer (1922). There is a *valesina* gene which acts as a sex-controlled dominant. Females homozygous or heterozygous for *valesina* both show the characteristic coloration, but male *valesina* specimens are indistinguishable in appearance from normal males. Fischer (1929-30) reports the occurrence of very rare *valesina* males, but Ford (1975) suggests that these might be intersexes, or alternatively, that their appearance might be due to a gene other than the *valesina* allele. Goldschmidt and Fischer did a number of experimental crosses using males known to be of normal, heterozygote or *valesina* genotype, with a similar range of females. When normal males (*v v*) were crossed with heterozygous *valesina* females (*V v*), the ratio of offspring was as expected: 50% males, 25% normal females, 25% *valesina* females. A series of reciprocal crosses, however, with *V v* males and *v v* females, gave a significant deficiency of *valesina* females amongst the offspring. There was also a slight deficiency of *valesina* females in the offspring when both parents were heterozygotes (*V v*). Ford (1975) suggests two possible explanations. Sperms carrying the *V* gene may be at some disadvantage compared to those carrying *v* ("meiotic drive") and/or sperm carrying *V* may be at a disadvantage in fertilising *v* eggs, but not *V* eggs. Thus the low frequency or absence of *valesina* females in European populations might in part be explained, but the *valesina* morph must have some compensating advantage to be retained in a stable polymorphism in any population at all. Furthermore, *A. paphia* has a Palaearctic distribution and towards the far East *valesina* becomes much commoner. It is reported that in southern China all the females are *valesina* (Ford 1975).

In northern West Germany *valesina* is relatively common, but it is rarer in the south-west. Magnus (1958) investigated the reaction of males to the colour and pattern of females in the south-west and in laboratory stocks derived from these southern populations. He concluded that the colour of the normal female elicited the first phase of male courtship behaviour at a distance, and that the fulvous colour rather than the overall pattern was the critical feature. He was also able to show that "supernormal releasers", larger than life model females or bands of rotating colour, elicited an even stronger response. The *valesina* colour, on the other hand, did not stimulate the approach of the male, although females of either morph could stimulate the next phase of courtship if the males were near enough to detect the female pheromones. Magnus expressed surprise at the rarity of the *valesina* form when it was a genetic dominant, suggesting some misunderstanding of evolutionary genetics. Nevertheless *valesina* females must have some compensating advantage to be retained as a distinct morph in a population at all. The aim of our field work was to detect any behavioural advantage in wild populations. We chose Corsica where *valesina* is known to occur at relatively high frequency in some populations (Bretherton & de Worms 1963, Panchen & Panchen 1973).

Argynnis paphia in Corsica

In Corsica the Silver-washed Fritillary occurs as what is usually considered to be a distinct sub-species *A. paphia immaculata* Bellier, which is also the only form on the neighbouring islands of Sardinia, Elba and Giglio. Apparently transitional forms are found in Sicily and elsewhere near the Mediterranean coast (Higgins & Riley 1983). The sub-specific name refers to the reduction or absence of the characteristic "silver washings" of *A. paphia paphia* (Bretherton & De Worms 1963) but there is considerable variation in the degree of this reduction (Panchen & Panchen 1973). Bretherton and De Worms estimated the frequency of *valesina* in populations in the forest of Vizzavona, central Corsica (altitude ca. 1000m) at between five and eight per cent of all females. In 1972 the impression was that *valesina* females were at a higher frequency in the Restonica valley some 20 km away (500 - 600 m) but an accurate estimate was not possible (Panchen & Panchen 1973).

Bretherton and De Worms also noted a difference in behaviour between normal and *valesina* females in Corsica. Their estimate of the frequency of *valesina* "was complicated by the fact that their habits seemed to differ from those of typical females: they fed more warily, settled more on mossy stones, and paid more frequent visits to the branches of beech trees which served both sexes as dormitories at night and in cloudy weather". Panchen and Panchen corroborated these observations from specimens in the Gorge de la Restonica: the *valesina* females often settled on mossy stones, against which they were cryptic, but were not seen feeding, whereas males and normal females, apart from feeding on brambles, were particularly attracted to the low yellow-flowered thistles, *Carlina corymbosa,* which are attractive to many butterfly species.

The observations reported below were made during the summer of 1988, when we visited Corsica as the University of Newcastle upon Tyne Expedition, working principally on the variation and distribution of *Coenonympha corinna,* the Corsican Heath butterfly (Brunton *et al.* in prep.). Although we saw several *A. paphia* populations, only one was satisfactory for our purposes, in that *valesina* was present and the whole group, at least when feeding, were together in a small defined area. The locality was at about 1 km inland of the village of Olmeta-di-Capocorso, which is itself about 3 km inland from the west coast of Cap Corse, the long northward pointing peninsula at the eastern end of the island. The *paphia* locality was on the south bank of the small mountain River Pierrago at an altitude of about 400 m. It consisted of an area of about 6 m (along the river) by 3.6 m, bounded at the east and west by riverside trees and at the south by derelict garden land which dropped down to the site about 1.5 m below at a low wall. We were thus able to look down on the site, making observations particularly easy. The whole site area was dominated by a dense growth of the Corsican hemp agrimony, *Eupatorium cannabinum* L., subsp. *corsicum,* the plants themselves being about 1.5 m high with pale pinkish purple flowers, on which the butterflies were feeding avidly. Other species visiting the site were *Limenitis reducta* Staudinger, *Pandoriana pandora* (Schiff.) and a small, blue lycaenid, but *A. p. immaculata* were in the overwhelming majority.

Observations

We first discovered the Olmeta population in the late afternoon of 5th August 1988 and were able to visit it on four subsequent days, the 6th, 9th, 11th and 13th August. On this last day we were able to see the first arrival of the butterflies on the patch while on the previous Saturday, 6th August, we arrived at about 10.00 am to find one or two already there. On two occasions (9th and 11th August) we did not leave the site until sundown, after the butterflies had left to roost in the surrounding trees. We can therefore reconstruct, with reasonable certainty, a whole day's activity of the butterflies on the feeding site. We also recorded shade temperature throughout. The weather was clear during the whole period of our observations and the mid-day temperature reached a shade temperature of between 26°C and a little above 30°C. Sunrise was approximately 7.00 am but because of the surrounding hills and trees the patch remained in the shade until approximately 9.30 am when the shade temperature was about 20°C. By 10.00 am the whole patch was in full sun and the temperature rising towards its maximum. Maximum temperature was reached soon after 11.00 am and persisted with little change until about 4.00 pm. The sun had left the patch somewhat after 6.00 pm.

The first butterfly to arrive at the site, between 9.30 and 10.00 am was a male, to be followed at first only by males. Females arrived as the patch moved into full sunlight. On both occasions when we were there, *valesina* females were the first to arrive followed by normal females. At 10.15 am we recorded 13 butterflies including four *valesina*. We never saw more than four together, however, and a rather subjective estimate, with butterflies continually leaving and re-appearing at the site, was that they represented about 30% of all females. Towards mid-day, as the temperature approached 30°C, the females left the patch and flew off into the shade of the trees, presumably to their night-time roosts. It was noticeable that the *valesina* females seemed to have slightly greater tolerance of the high temperature than normal females and tended to stay on the patch a little longer. The males stayed throughout the day, sitting conspicuously on the tops of the flowers, even in the mid-day heat, and fluttering from flower to flower. The females did not return to the patch until the temperature started to drop at about 4.00 pm. Any courtship activity was thus restricted to 10 - 11 am and 4 - 6 pm. Magnus (1958) notes that it has been shown by Vielmetter (1954 and personal communication) that *A. paphia* is capable of behavioural temperature control with an optimal temperature when active of about 34°C. Presumably males (and perhaps *valesina* to a lesser degree) either heat up less under the same conditions of sun and ambient temperature, or have a higher optimum.

We were able to see a number of episodes of courtship behaviour but no actual mating. Courtship was usually initiated by the male pursuing the female and in some cases the females adopted a "calling" attitude. In the case of the *valesina* females, however, we saw a number of occasions when the female approached the male, something that normal females never did. One other feature of *valesina* is of note. They are undoubtedly cryptic against a background of grey-green foliage and the specimens at Olmeta often fed at flowers on shorter plants than did normal females or the very conspicuous males. When not apparently feeding the *valesina* females were sometimes seen to settle low in the foliage where they were quite difficult to spot.

Discussion

The *valesina* morph of *A. paphia* appears to be at a disadvantage to the normal female morph,firstly,because when a male carries the *valesina* gene there is abnormal genetic segregation of its offspring with a deficiency in female *valesina*, and, secondly, because of the apparent behavioural disadvantage to the *valesina* morph in courtship, as reported by Magnus. Previous reports of the behaviour of *valesina* females in *A. paphia paphia* (Ford 1975) suggest another behavioural difference. Males and normal females are to be seen in sunny woodland clearings and pathways, while *valesina* females are restricted to the shade of trees. These observations are to some extent repeated by the previous accounts of behaviour of *valesina* in *A. paphia immaculata* on Corsica. Bretherton and De Worms (1963) and Panchen and Panchen (1973) both emphasised the separation by preferred habitat and behaviour of *valesina,* together with its cryptic coloration. The Olmeta population was, however, a coherent whole, although we were again struck by the cryptic appearance and sometimes behaviour of *valesina.* There were, however, two new features, the apparently greater temperature tolerance of *valesina,* compared to normal females, and the active part played by *valesina* females in initiating courtship. If repeated in other populations,these factors, together with the evident crypsis, might give *valesina* females the compensating advantage necessary to maintain the *valesina* gene in a population at a significant frequency.

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Two old records of Lepidoptera in Jersey

G.B. Coney was an amateur entomologist resident, at least during his later years, in Dorset, but with connections in Jersey, Channel Islands. He published an important early list of Lepidoptera taken in Jersey in 1903 (*Entomologist* **37**: 127-131). His collection is in the City of Bristol Museum